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TEST REPORT

Report No. .....:	**GTI20190655E**
Applicant .....:	**Lumi United Technology Co., Ltd.**
Address .....:	8th Floor, JinQi Wisdom Valley, No.1 Tangling Road, Liuxian Ave, Taoyuan Residential District, Nanshan District, Shenzhen.
Manufacturer..... .....:	Lumi United Technology Co., Ltd
Address.....:	8th Floor, JinQi Wisdom Valley, No.1 Tangling Road, Liuxian Ave, Taoyuan Residential District, Nanshan District, Shenzhen.
Product Name .....:	**Water Leak Sensor T1**
Trade Mark .....:	AQara
Model/Type reference.....:	WLS-S01
Listed Model(s).....:	SJCGQ12LM,SJCGQ12LM-G0
Standard.....:	**ETSI EN 300 328 V2.1.1: 2016-11**
Date of receipt of test sample...:	Apr. 16, 2019
Date of testing.....:	Apr. 17, 2019 to Apr. 27, 2019
Date of issue.....:	Aug. 14, 2019
Result.....:	**PASS**

Compiled by: (Printed name+signature)	Zaki Zhang	Zaki Zhang
Supervised by: (Printed name+signature)	Miller Ma	Miller Ma
Approved by: (Printed name+signature)	Walter Chen	

Testing Laboratory Name .....:	**CTC Laboratories, Inc.**
Address .....:	1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Shenzhen, Guangdong, China

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1. TEST SUMMARY

1.1. Test Standards

The tests were performed according to following standards:

ETSI EN 300 328 V2.1.1 (2016-11)–Wideband transmission systems; Data transmission equipment operating in the 2,4 GHz ISM band and using wide band modulation techniques; Harmonised Standard for access to radio spectrum

1.2. Report version

Revised No.	Date of issue	Description
01	Aug. 14, 2019	Original

1.3. Test Description

Radio Spectrum Matter (RSM) Part of Transmitter			
Test Item	**Test require**	**Result**	**Test Enigeer**
Maximum transmit power	clause 4.3.2.2	Pass	Zaki Zhang
Power Spectral Density	clause 4.3.2.3	Pass	Zaki Zhang
Duty Cycle, Tx-sequence, Tx-gap	clause 4.3.2.4	Pass	Zaki Zhang
Medium Utilisation (MU) factor	clause 4.3.2.5	Pass	Zaki Zhang
Adaptivity	clause 4.3.2.6	N/A	N/A
Occupied Channel Bandwidth	clause 4.3.2.7	Pass	Zaki Zhang
Transmitter unwanted emissions in the out-of-band domain	clause 4.3.2.8	Pass	Zaki Zhang
Transmitter unwanted emissions in the spurious domain	clause 4.3.2.9	Pass	Zaki Zhang
Radio Spectrum Matter (RSM) Part of Receiver			
Test Item	**Test require**	**Result**	**Test Enigeer**
Receiver spurious emissions	clause 4.3.2.10	Pass	Zaki Zhang
Receiver Blocking	clause 4.3.2.11	Pass	Zaki Zhang
Geo-location capability	clause 4.3.2.12	N/A	N/A

Note:

1. The measurement uncertainty is not included in the test result.

2. N/A: means this test item is not applicable for this device according to the technology characteristic of device.

1.4. Test Facility

Address of the report laboratory

CTC Laboratories, Inc.

Add: 1-2/F., Building 2, Jiaquan Building, Guanlan High-Tech Park, Shenzhen, Guangdong, China

Laboratory accreditation

The test facility is recognized, certified, or accredited by the following organizations:

CNAS-Lab Code: L5365
CTC Laboratories, Inc. has been assessed and proved to be in compliance with CNAS-CL01 Accreditation Criteria for Testing and Calibration Laboratories (identical to ISO/IEC17025: 2005 General Requirements) for the Competence of Testing and Calibration Laboratories.

A2LA-Lab Cert. No.: 4340.01
CTC Laboratories, Inc. EMC Laboratory has been accredited by A2LA for technical competence in the field of electrical testing, and proved to be in compliance with ISO/IEC 17025: 2005 General Requirements for the Competence of Testing and Calibration Laboratories and any additional program requirements in the identified field of testing.

ISED Registration No.: CN0029

The 3m alternate test site of CTC Laboratories, Inc. EMC Laboratory has been registered by Certification and Engineer Bureau of Industry Canada for the performance of with Registration NO.: CN0029 on Dec, 2018.

FCC-Registration No.:CN1208

CTC Laboratories, Inc. EMC Laboratory has been registered and fully described in a report filed with the (FCC) Federal Communications Commission. The acceptance letter from the FCC is maintained in our files. RegistrationCN1208, Sep 07, 2017

1.5. Measurement Uncertainty

The data and results referenced in this document are true and accurate. The reader is cautioned that there may be errors within the calibration limits of the equipment and facilities. The measurement uncertainty was calculated for all measurements listed in this test report acc. to TR-100028-01" Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 1" and TR-100028-02 "Electromagnetic compatibility and Radio spectrum Matters (ERM);Uncertainties in the measurement of mobile radio equipment characteristics; Part 2 " and is documented in the CTC Laboratories, Inc. quality system acc. to DIN EN ISO/IEC 17025. Furthermore, component and process variability of devices similar to that tested may result in additional deviation. The manufacturer has the sole responsibility of continued compliance of the device.

Below is the best measurement capability for CTC Laboratories, Inc.

Test Items	Measurement Uncertainty	Notes
Maximum transmit power	±1.5dB	(1)
Power Spectral Density	±1.5dB	(1)
Duty Cycle, Tx-sequence, Tx-gap	±5%	(1)
Accumulated Transmit Time, Frequency Occupation and Hopping Sequence	±5%	(1)
Hopping Frequency Separation	±5%	(1)
Medium Utilisation (MU) factor	±5%	(1)
Adaptively	±5%	(1)
Occupied Channel Bandwidth	±5%	(1)
Transmitter unwanted emissions in the out-of-band domain	±2.8dB	(1)
Transmitter unwanted emissions in the spurious domain	±2.8dB	(1)
Receiver spurious emissions	±2.8dB	(1)
Receiver Blocking	±2.8dB	(1)

Note(1): This uncertainty represents an expanded uncertainty expressed at approximately the 95% confidence level using a coverage factor of k=1.96.

1.6. Environmental conditions

Normal Condition	Temperature	+15 °C to +35 °C
	Relative humidity	20% to 75%.
	Voltage	the equipment shall be the nominal voltage for which the equipment was designed.
Extreme Condition	Temperature	Measurements shall be made over the extremes of the operating temperature range as declared by the manufacturer
	Voltage	Measurements shall be made over the extremes of the operating temperature range as declared by the manufacturer

Normal Condition	T_N=Normal Temperature	25 °C
Extreme Condition	T_L=Lower Temperature	-10 °C
	T_H=Higher Temperature	55 °C

2. GENERAL INFORMATION

2.1. General Description of EUT

Product Name:	Water Leak Sensor T1
Model/Type reference:	AQara
Trademark:	WLS-S01
Listed models:	SJCGQ12LM, SJCGQ12LM-G0
Model Difference:	All these models are identical in the same PCB, layout and electrical circuit, only named differently for marketing purpose.
Power supply:	3Vdc from button battery
Hardware version:	V1.0.1
Software version:	V1.0.1
Zigbee	
Supported type:	Zigbee IEEE 802.15.4
Modulation:	O-QPSK
Operation frequency:	2405-2480MHz
Channel number:	16
Channel separation:	5 MHz
Antenna type:	PCB Antenna
Antenna gain:	2dBi
EUT Classification	
Type of equipment:	☐ stand alone equipment ☐ plug in radio equipment ☒ combined equipment
Modulation types:	☒ Wide Band Modulation (None Hopping – e.g. DSSS, OFDM) ☐ Frequency Hopping Spread Spectrum (FHSS)
Adaptive/Non- adaptive:	☒Adaptive, LBT-based ☐HFSS The maximum number of Hopping Frequencies:/ The minimum number of Hopping Frequencies: / Max. Dwell time:/ ☐Frame Based ☐Load Based ☐switch dynamically between Frame Based and Load Based
	☐ Adaptive, non-LBT-based

	☒ Adaptive (Operating in a non-adaptive mode.)
	☐ Non- adaptive
Antennas and transmit operating modes:	Operating mode 1 (single antenna) ☒ Equipment with only 1 antenna ☐ Equipment with 2 diversity antennas but only 1 antenna active at any moment in time ☐ Smart Antenna Systems with 2 or more antennas, but operating in a (legacy) mode where only 1 antenna is used.

Note: For more detailed features description, please refer to the manufacturer's specifications or the User's Manual.

2.2. Description of Test Modes and Test Frequency

The EUT has been tested under typical operating condition. The Applicant provides communication tools software to control the EUT for staying in continuous transmitting and receiving mode for testing.

Operation Frequency List:

Channel	Frequency (MHz)
11	**2405**
12	2410
13	2415
14	2420
15	2425
16	2430
17	2435
18	**2440**
19	2445
20	2450
21	2455
22	2460
23	2465
24	2470
25	2475
26	**2480**

Note: The line display in grey were the channel selected for testing

2.3. Measurement Instruments List

Tonscend JS0806-2 Test system						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated until
1	Spectrum Analyzer	Rohde & Schwarz	FSU26	100105	Dec 29 ,2018	Dec 28 ,2019
2	MXG Vector Signal Generator	Agilent	N5182A	MY47420864	Dec 29 ,2018	Dec 28 ,2019
3	Signal Generator	Agilent	E8257D	MY46521908	Dec 29 ,2018	Dec 28 ,2019
4	Power Sensor	KEYSIGHT	U2021XA	MY5365004	Dec 29 ,2018	Dec 28 ,2019
5	Power Sensor	KEYSIGHT	U2021XA	MY5365006	Jun. 23, 2018	Jun. 22 2019
6	Simultaneous Sampling DAQ	Agilent	U2531A	TW54493510	Jun. 23, 2018	Jun. 22 2019
7	Climate Chamber	TABAI	PR-4G	A8708055	Dec 29 ,2018	Dec 28 ,2019
8	Wideband Radio Communication Tester	Rohde & Schwarz	CMW500	116410	Dec 29 ,2018	Dec 28 ,2019
9	Climate Chamber	ESPEC	MT3065	/	Dec 29 ,2018	Dec 28 ,2019
10	300328 v2.1.1 test system	TONSCEND	v2.6	/	/	/

Transmitter spurious emissions & Receiver spurious emissions						
Item	Test Equipment	Manufacturer	Model No.	Serial No.	Calibrated Date	Calibrated until
1	EMI Test Receiver	Rohde & Schwarz	ESCI	100658	Dec 29 ,2018	Dec 28 ,2019
2	High pass filter	micro-tranics	HPM50111	142	Dec 29 ,2018	Dec 28 ,2019
3	Log-Bicon Antenna	Schwarzbeck	CBL6141A	4180	Dec 29 ,2018	Dec 28 ,2019
4	Ultra-Broadband Antenna	ShwarzBeck	BBHA9170	25841	Dec 29 ,2018	Dec 28 ,2019
5	Loop Antenna	LAPLAC	RF300	9138	Dec 29 ,2018	Dec 28 ,2019
6	Spectrum Analyzer	Rohde & Schwarz	FSU26	100105	Dec 29 ,2018	Dec 28 ,2019
7	Horn Antenna	Schwarzbeck	BBHA 9120D	647	Dec 29 ,2018	Dec 28 ,2019
8	Pre-Amplifier	HP	8447D	1937A03050	Dec 29 ,2018	Dec 28 ,2019
9	Pre-Amplifier	EMCI	EMC051835	980075	Dec 29 ,2018	Dec 28 ,2019
10	Antenna Mast	UC	UC3000	N/A	N/A	N/A
11	Turn Table	UC	UC3000	N/A	N/A	N/A
12	Cable Below 1GHz	Schwarzbeck	AK9515E	33155	Dec 29 ,2018	Dec 28 ,2019
13	Cable Above 1GHz	Hubersuhner	SUCOFLEX102	DA1580	Dec 29 ,2018	Dec 28 ,2019

Note: The cable loss has calculated in test result which connection between each test instruments.

3. TEST ITEM AND RESULTS

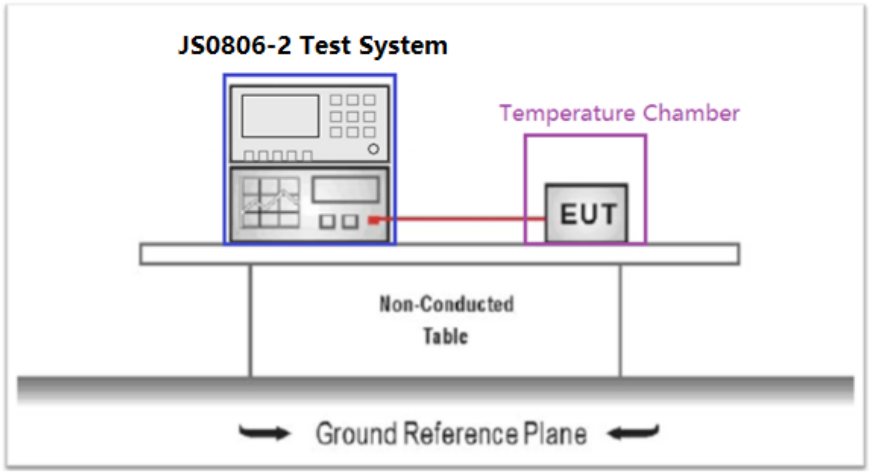
3.1. RF Output Power

Limit

ETSI EN 300 328 Sub-clause 4.3.2.2.3

1. For adaptive equipment using wide band modulations other than FHSS, the maximum RF output power shall be 20 dBm.
2. The maximum RF output power for non-adaptive equipment shall be declared by the supplier and shall not exceed 20 dBm. For non-adaptive equipment using wide band modulations other than FHSS, themaximum RF output power shall be equal to or less than the value declared by the supplier.

Test Configuration



Test Procedure

Please refer to ETSI EN 300 328 Sub-clause 5.4.2.2.1 for the measurement method.

Test Results

Test conditions Temperature (°C)	Channel	EIRP (dBm)	Limit (dBm)	Result
T_N	LCH	11.67	20.00	Pass
	MCH	11.70		
	HCH	11.48		
T_L	LCH	11.55		
	MCH	11.61		
	HCH	11.31		
T_H	LCH	11.51		
	MCH	11.59		
	HCH	11.37		

Note:

1) Test bursts: 45.

2) Measured Power(EIRP) include the cable loss and antenna gain.

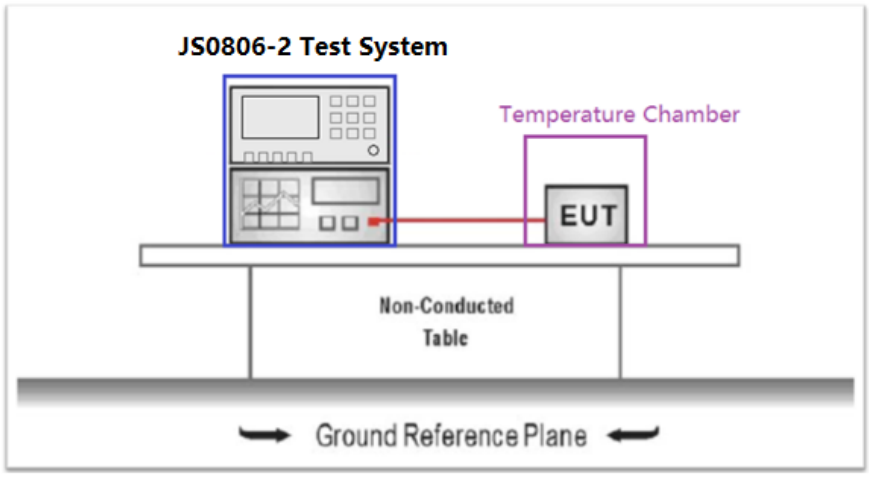
3.2. Power Spectral Density

Limit

ETSI EN 300 328Sub-clause 4.3.2.3.3

For equipment using wide band modulations other than FHSS, the maximum Power Spectral Density is limited to10 dBm per MHz.

Test Configuration



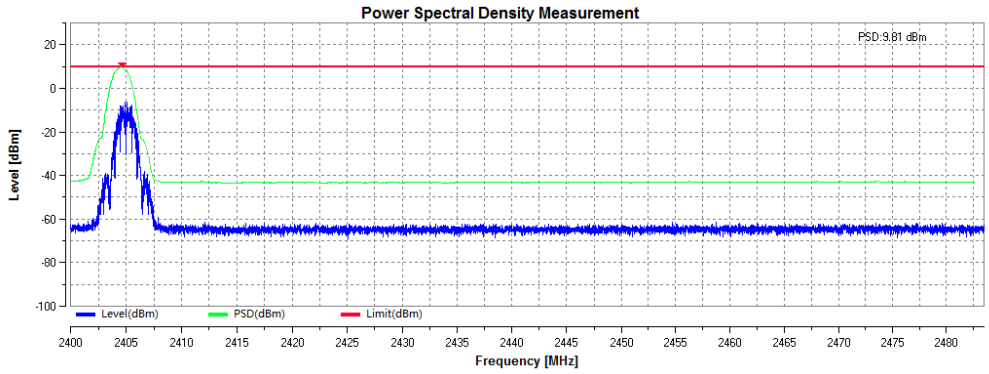
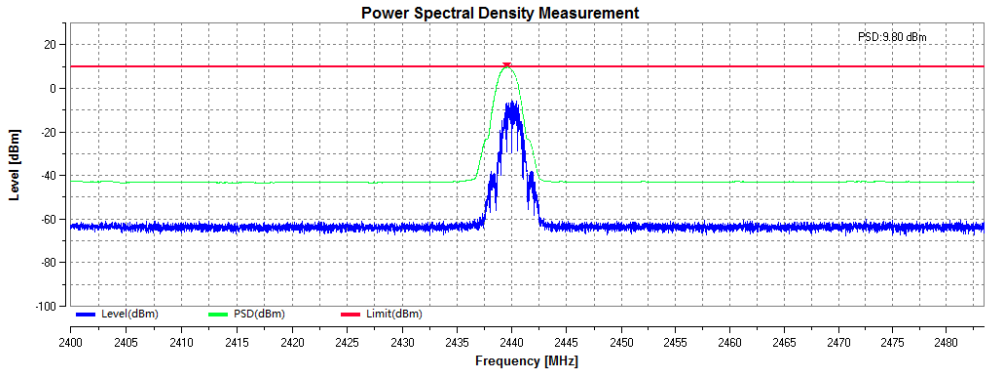
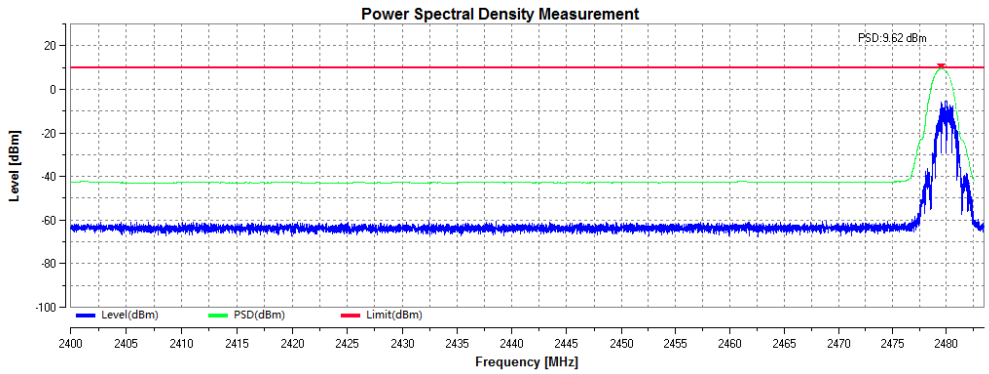
Test Procedure

Please refer to ETSI EN 300 328 Sub-clause 5.4.3.2.1 for the measurement method.

Test Result

Channel	Power Spectral Density (dBm/MHz)	Limit (dBm/MHz)	Result
LCH	9.81	10.00	Pass
MCH	9.80		
HCH	9.62		

Note: Measured level include the cable loss and antenna gain.

LCH:	
MCH:	
HCH:	

Power Spectral Density Measurement
PSD:9.81 dBm
Level [dBm]
Level(dBm)
PSD(dBm)
Limit(dBm)
Frequency [MHz]

Power Spectral Density Measurement
PSD:9.80 dBm
Level [dBm]
Level(dBm)
PSD(dBm)
Limit(dBm)
Frequency [MHz]

Power Spectral Density Measurement
PSD:9.62 dBm
Level [dBm]
Level(dBm)
PSD(dBm)
Limit(dBm)
Frequency [MHz]

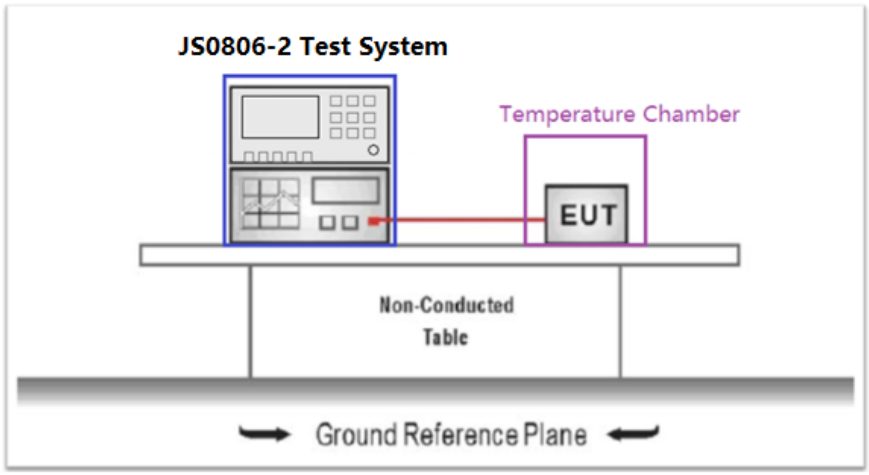
3.3. Duty Cycle, Tx-sequence, Tx-gap

Limit

ETSI EN 300 328 V2.1.1 Sub-clause 4.3.1.3.3 & 4.3.2.4.3

1. For non-adaptive FHSS equipment, the Duty Cycle shall be equal to or less than the maximum value declared by the supplier. In addition, the maximum Tx -sequence time shall be 5 ms while the minimum Tx-gap time shall be 5 ms.
2. For equipment using wide band modulations other than FHSS, the Duty Cycle shall be equal to or less than the maximum value declared by the supplier.
   The Tx-sequence time shall be equal to or less than 10 ms. The minimum Tx-gap time following a Tx-sequence shall be equal to the duration of that proceeding Tx-sequence with a minimum of 3,5 ms.

Test Configuration

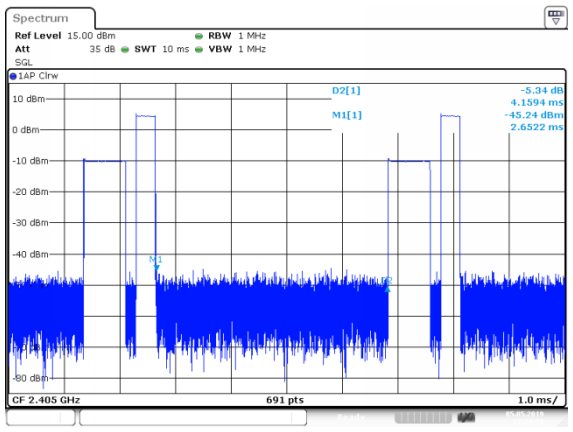


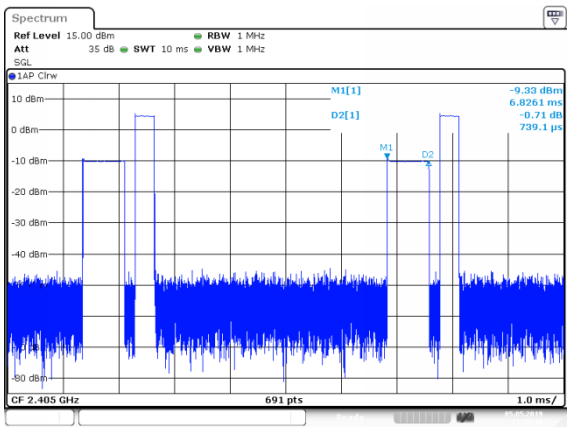
Test Procedure

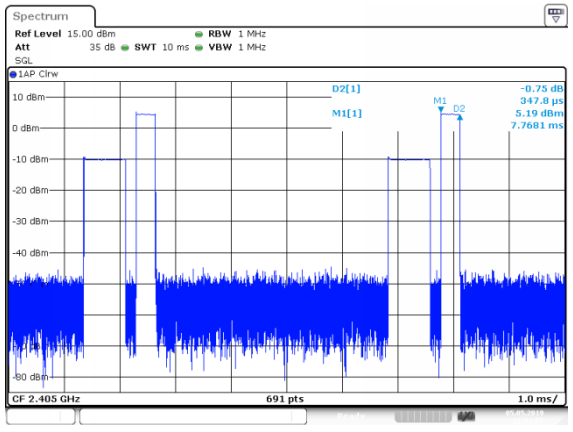
Please refer to ETSI EN 300 328 Sub-clause 5.4.2.2.1.3 for the measurement method.

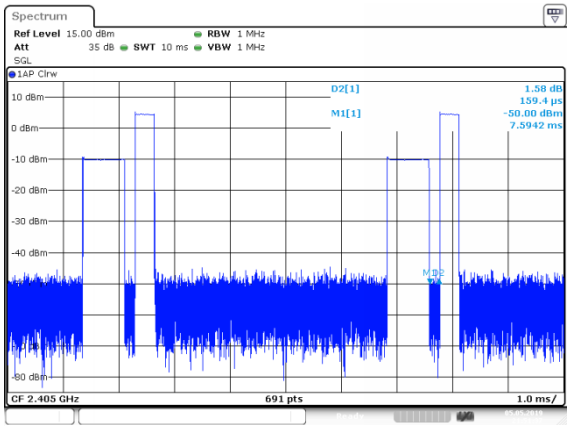
Test Results

	Test Date(ms)	Limit(ms)	Duty Cycle(%)	Result
Tx-sequence	1.086	<10 ms	20.10	Pass
Tx-gap	4.318	>3.5 ms		Pass









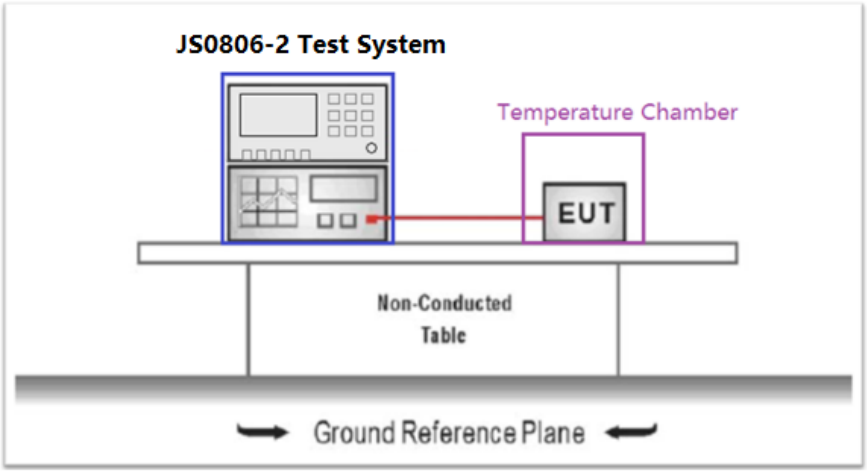
3.4. Medium Utilisation (MU) factor

Limit

ETSI EN 300 328 V2.1.1 Sub-clause 4.3.1.6.3&4.3.2.5.3

The maximum Medium Utilisation factor for non-adaptive equipment shall be 10 %.

Test Configuration



Test Procedure

Please refer to ETSI EN 300 328 Sub-clause 5.4.2.2.1.4 for the measurement method.

Test Results

Remark: We test all modulation type, and recorded the worst case.

Test channel	EIRP (dBm)	EIRP (mW)	Duty Cycle	Test MU(%)	Limit(%)	Result
MCH	11.70	14.79	20.10	2.97	<10	Pass

Note: $MU = (P / 100\ mW) \times DC$

MU is Medium Utilization.

P is the RF output power as defined in clause 4.3.2.2.2 expressed in mW.

DC is the Duty Cycle as defined in clause 4.3.2.4.2 expressed in %.

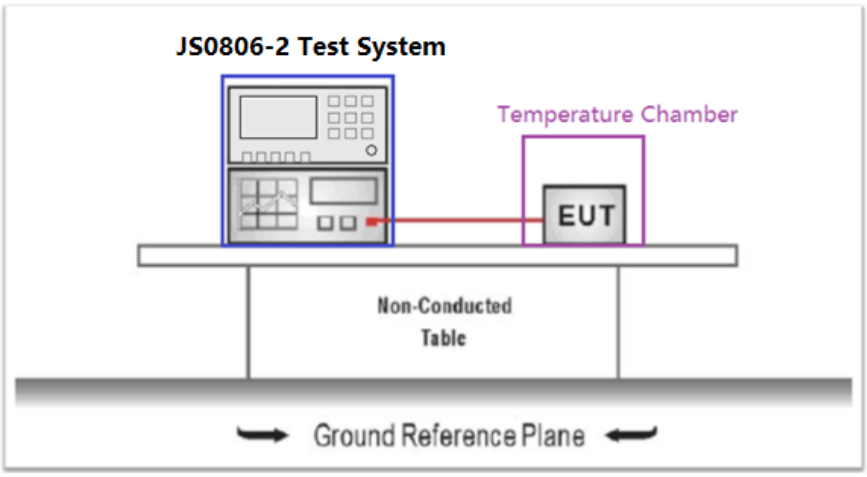
3.5. Occupied Channel Bandwidth

Limit

ETSI EN 300 328 Sub-clause 4.3.2.7.3

1. The Occupied Channel Bandwidth shall fall completely within the band given in the band 2,4 GHz to 2,4835 GHz.
2. In addition, for non-adaptive equipment using wide band modulations other than FHSS and with e.i.r.p greater than10 dBm, the occupied channel bandwidth shall be less than 20 MHz.

Test Configuration

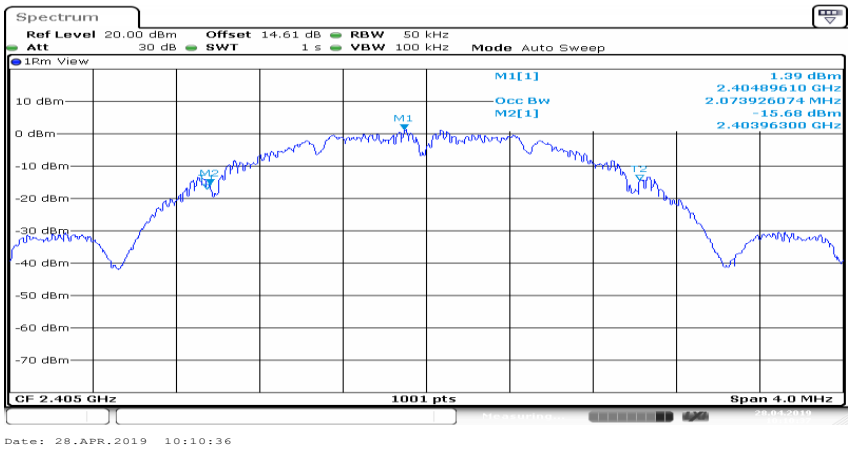
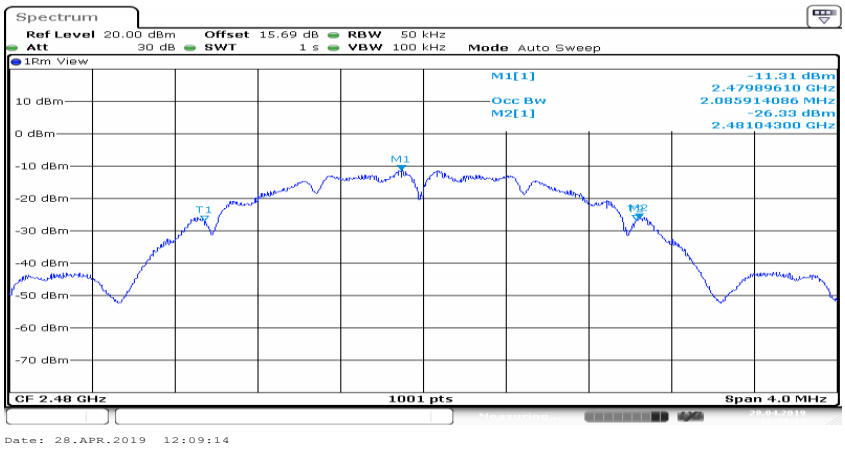


Test Procedure

Please refer to ETSI EN 300 328 Sub-clause 5.4.7.2.1 for the measurement method.

Test Result

Channel	Measured Frequency (MHz)		Limit (MHz)	Result
	F_{lower}	F_{higher}		
LCH	2403.96	-	2400.00~2483.50	Pass
HCH	-	2481.04		

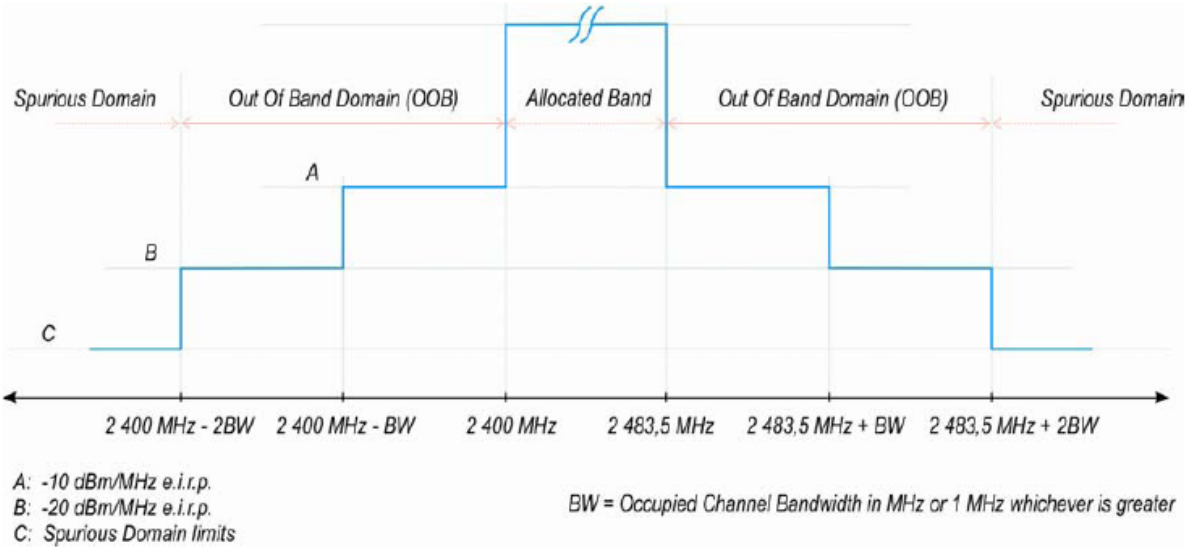
LCH:	 Spectrum Ref Level 20.00 dBm Offset 14.61 dB RBW 50 kHz Att 30 dB SWT 1 s VBW 100 kHz Mode Auto Sweep 1Rm View M1[1] 1.39 dBm 2.40489610 GHz Occ Bw 2.073926074 MHz M2[1] -15.68 dBm 2.40396300 GHz 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm CF 2.405 GHz 1001 pts Span 4.0 MHz Date: 28.APR.2019 10:10:36
HCH:	 Spectrum Ref Level 20.00 dBm Offset 15.69 dB RBW 50 kHz Att 30 dB SWT 1 s VBW 100 kHz Mode Auto Sweep 1Rm View M1[1] -11.31 dBm 2.47989610 GHz Occ Bw 2.085914086 MHz M2[1] -26.33 dBm 2.48104300 GHz 10 dBm 0 dBm -10 dBm -20 dBm -30 dBm -40 dBm -50 dBm -60 dBm -70 dBm CF 2.48 GHz 1001 pts Span 4.0 MHz Date: 28.APR.2019 12:09:14

3.6. Transmitter unwanted emissions in the out-of-band domain

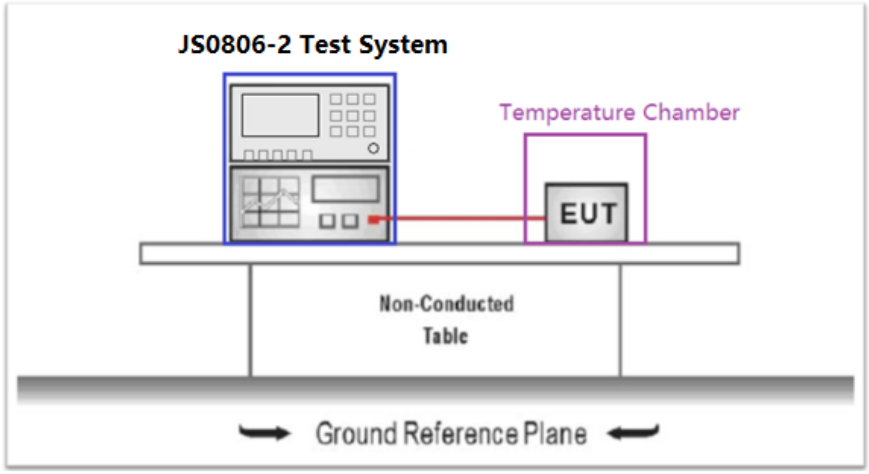
Limit

ETSI EN 300 328 V2.1.1 Sub-clause 4.3.1.9.3&4.3.2.8.3

The transmitter unwanted emissions in the out-of-band domain but outside the allocated band, shall not exceed the values provided by the mask in figure 1.



Test Configuration



Test Procedure

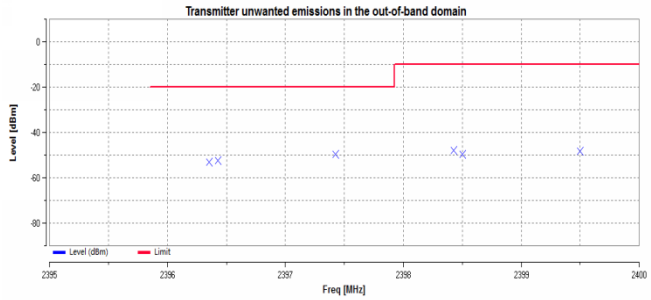
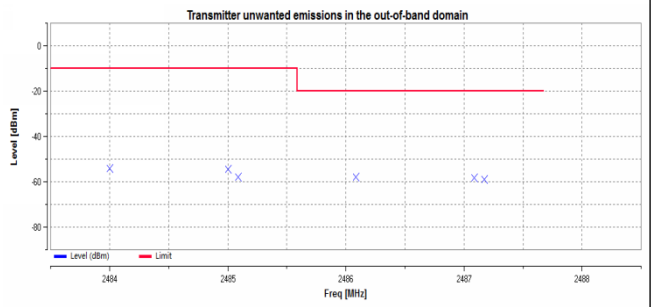
Please refer to ETSI EN 300 328 Sub-clause 5.4.8.2.1 for the measurement method.

Test Result

Remark: The datum recorded below represents the worst emission level in each segment and the plot for normal condition.

Frequency range (MHz)		Level (dBm)	Limit (dBm)	Result
Start	Stop			
2400-2OBW	2400-OBW	-49.71	<-20.00	Pass
2400-OBW	2400	-48.08	<-10.00	Pass
2483.5	2483.5+OBW	-54.15	<-10.00	Pass
2483.5+OBW	2483.5+2OBW	-57.79	<-20.00	Pass

Test plot as follows:

	
LCH	HCH

3.7. Transmitter unwanted emissions in the spurious domain-Conducted measurements

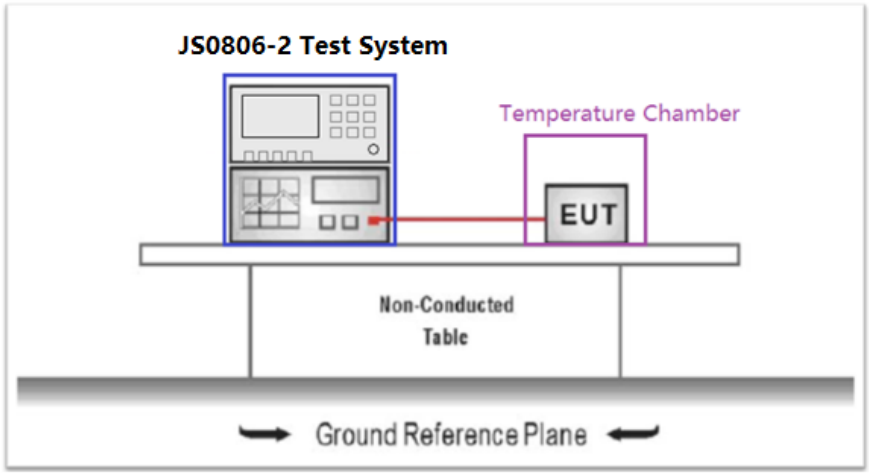
LIMIT

ETSI EN 300 328 Sub-clause 4.3.2.9.3

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in the below table

Frequency range	Maximum power	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87,5 MHz	-36 dBm	100 kHz
87,5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 862 MHz	-54 dBm	100 kHz
862 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12,75 GHz	-30 dBm	1 MHz

Test Configuration

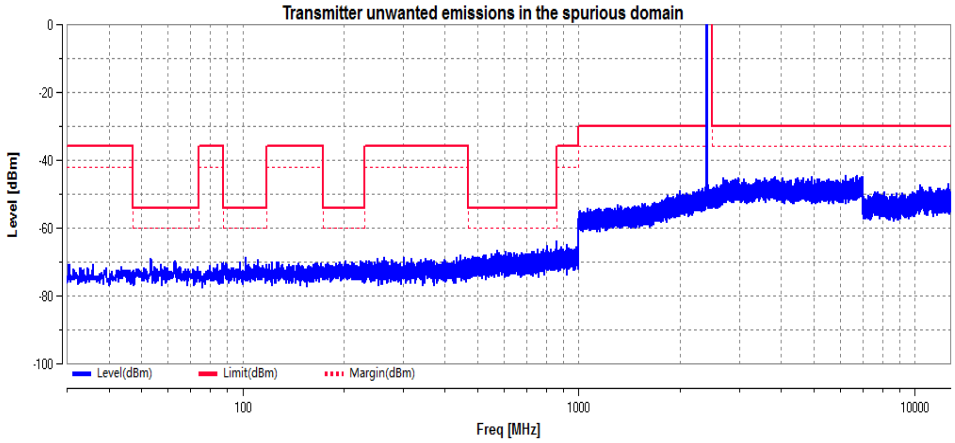


Test Procedure

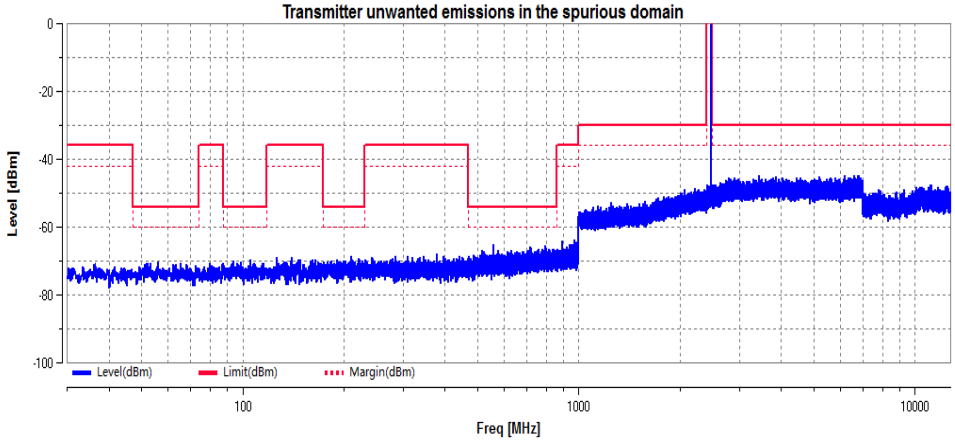
Please refer to ETSI EN 300 328 Sub-clause 5.4.9.2.1 for the measurement method.

Test Result

Test channel:	LCH



Test channel:	HCH



3.8. Transmitter unwanted emissions in the spurious domain-Radiated measurements

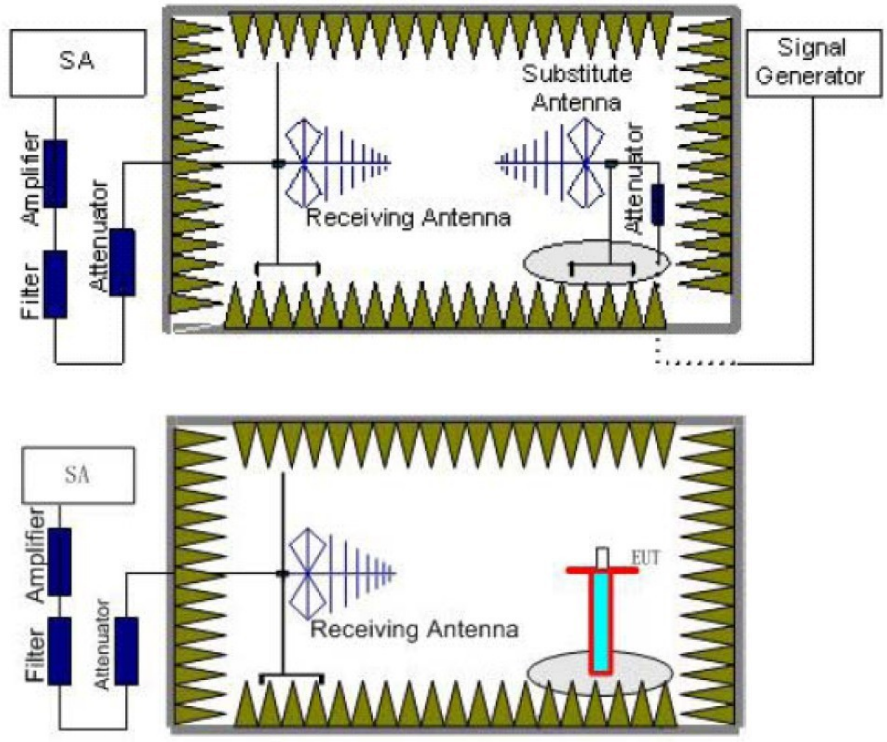
LIMIT

ETSI EN 300 328 Sub-clause 4.3.2.9.3

The transmitter unwanted emissions in the spurious domain shall not exceed the values given in the below table

Frequency range	Maximum power	Bandwidth
30 MHz to 47 MHz	-36 dBm	100 kHz
47 MHz to 74 MHz	-54 dBm	100 kHz
74 MHz to 87,5 MHz	-36 dBm	100 kHz
87,5 MHz to 118 MHz	-54 dBm	100 kHz
118 MHz to 174 MHz	-36 dBm	100 kHz
174 MHz to 230 MHz	-54 dBm	100 kHz
230 MHz to 470 MHz	-36 dBm	100 kHz
470 MHz to 862 MHz	-54 dBm	100 kHz
862 MHz to 1 GHz	-36 dBm	100 kHz
1 GHz to 12,75 GHz	-30 dBm	1 MHz

Test Configuration



Test Procedure

Please refer to ETSI EN 300 328 Sub-clause 5.4.9.2.2 for the measurement method.

Test Result

Remark: We test all modulation type, and recorded the worst case.

Channel	Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
		Polarization	Level (dBm)		
LCH	63.31	Vertical	-60.75	-54	Pass
	4810	Vertical	-56.02	-30	
	7215	Vertical	-55.14		
	9620	Vertical	-54.75		
	63.98	Horizontal	-62.81	-54	Pass
	4810	Horizontal	-53.51	-30	
	7215	Horizontal	-52.19		
	9620	Horizontal	-51.42		
HCH	63.31	Vertical	-60.75	-54	Pass
	4810	Vertical	-55.08	-30	
	7215	Vertical	-54..34		
	9620	Vertical	-53.09		
	63.98	Horizontal	-61.28	-54	Pass
	4810	Horizontal	-53.16	-30	
	7215	Horizontal	-52.28		
	9620	Horizontal	-50.87		

3.9. Receiver spurious emissions-Conducted measurements

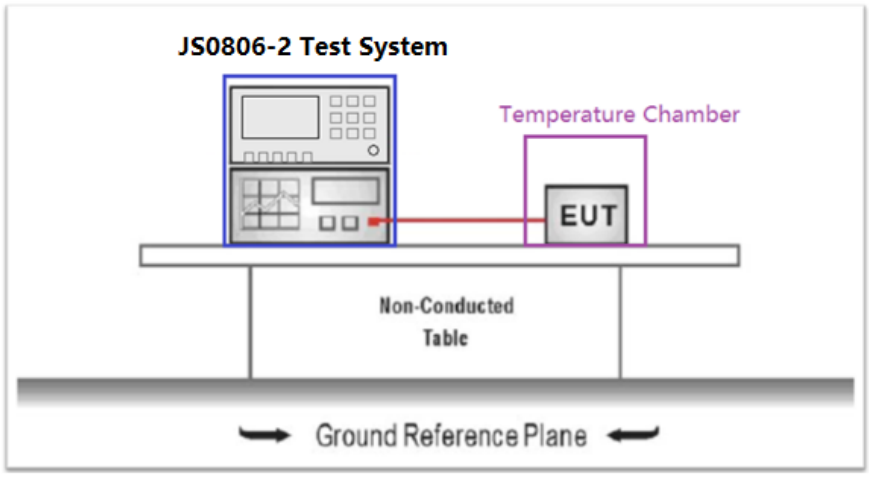
LIMIT

ETSI EN 300 328 Sub-clause 4.3.2.10.3

The spurious emissions of the receiver shall not exceed the values given in the below table

Frequency range	Maximum power	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12,75 GHz	-47 dBm	1 MHz

Test Configuration

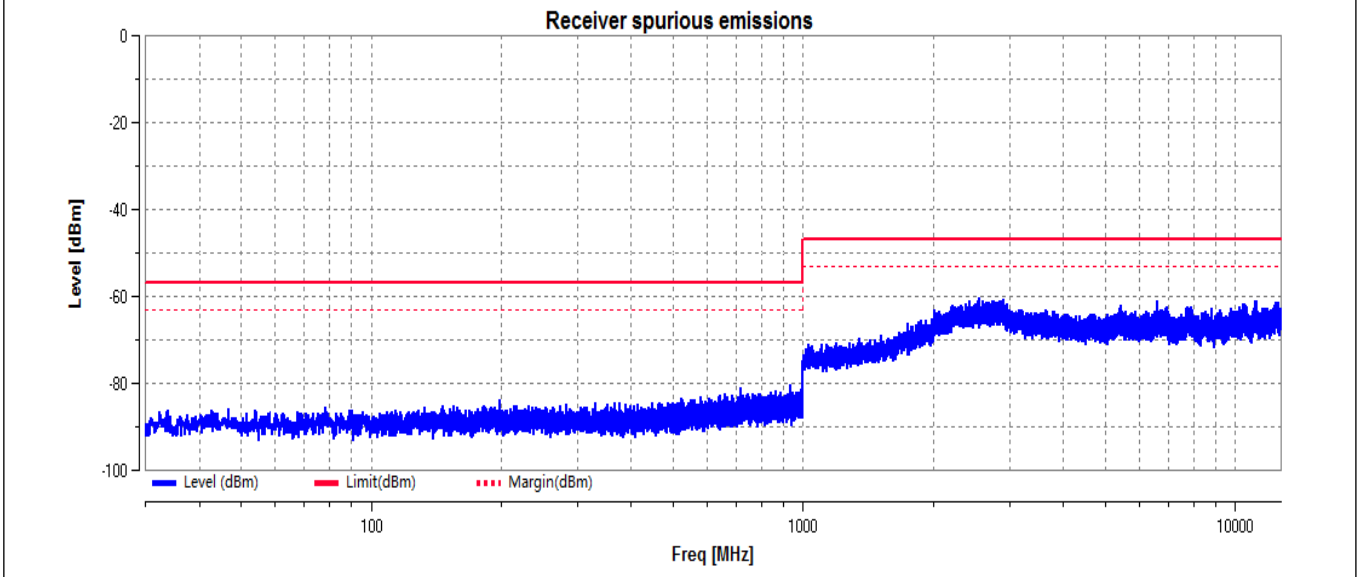


Test Procedure

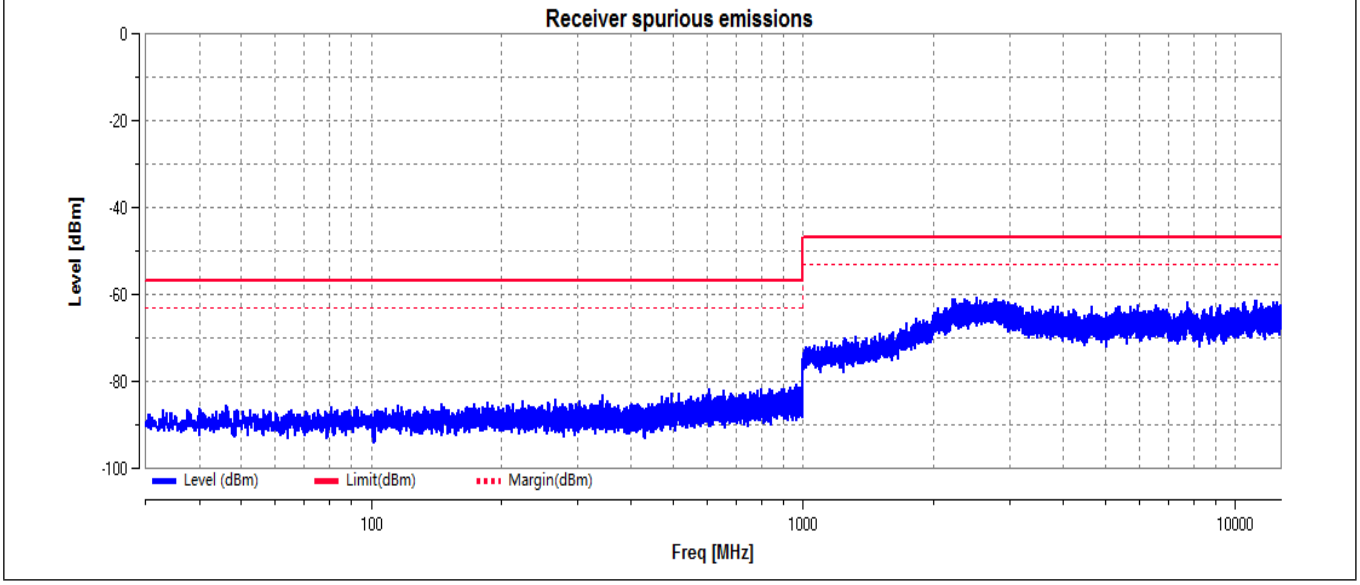
Please refer to ETSI EN 300 328 Sub-clause 5.4.10.2.1 for the measurement method.

Test Result

Zigbee	LCH



Zigbee	HCH



3.10. Receiver spurious emissions-Radiated measurements

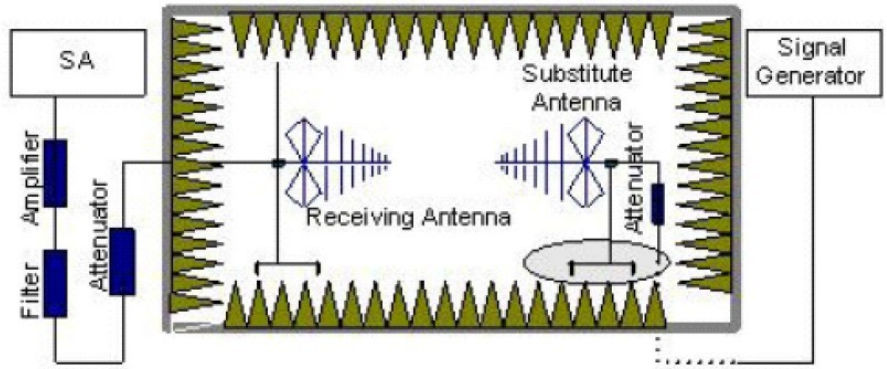
LIMIT

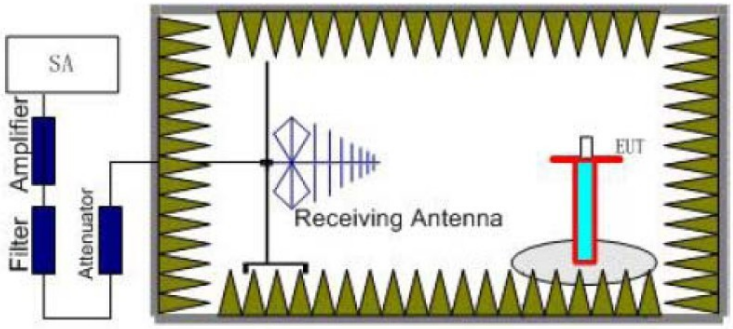
ETSI EN 300 328 Sub-clause 4.3.2.10.3

The spurious emissions of the receiver shall not exceed the values given in the below table

Frequency range	Maximum power	Measurement bandwidth
30 MHz to 1 GHz	-57 dBm	100 kHz
1 GHz to 12,75 GHz	-47 dBm	1 MHz

Test Configuration





Test Procedure

Please refer to ETSI EN 300 328 Sub-clause 5.4.10.2.2 for the measurement method.

Test Result

Remark: We test all modulation type, and recorded the worst case.

Zigbee					
Channel	Frequency (MHz)	Spurious Emission		Limit (dBm)	Result
		Polarization	Level (dBm)		
LCH	63.09	Vertical	-69.10	-57	Pass
	4810	Vertical	-60.62	-47	
	7215	Vertical	-58.19	-47	Pass
	9620	Vertical	-56.38	-47	
HCH	63.98	Horizontal	-68.19	-57	Pass
	4810	Horizontal	-59.07	-47	
	7215	Horizontal	-57.20	-47	Pass
	9620	Horizontal	-55.76	-47	

Note: The other emission levels are very lower than the limit and not show in test report.

3.11. Adaptivity

Limits

ETSI EN 300 328 Sub-clause 4.3.2.6

Non-LBT based Detect and Avoid

1) During normal operation, the equipment shall evaluate the presence of a signal on its current operating channel. Ifit is determined that a signal is present with a level above the detection threshold defined in step 5 the channelshall be marked as 'unavailable'.
2) The channel shall remain unavailable for a minimum time equal to 1 s after which the channel may be consideredagain as an 'available' channel.
3) The total time during which an equipment has transmissions on a given channel without re-evaluating theavailability of that channel, is defined as the Channel Occupancy Time.
4) The Channel Occupancy Time shall be less than 40 ms. Each such transmission sequence shall be followed by anIdle Period (no transmissions) of minimum 5 % of the Channel Occupancy Time with a minimum of 100 µs. Afterthis, the procedure as in step 1 needs to be repeated.
5) The detection threshold shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p.transmitter the detection threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to thereceiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive)antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels lessthan 20 dBm e.i.r.p., the detection threshold level may be relaxed to: TL = -70 dBm/MHz + 10 × log10 (100 mW / Pout) (Pout in mWe.i.r.p.)
6) The equipment shall comply with the requirements defined in step 1 to step 4 of the present clause in the presenceof an unwanted CW signal as defined in below table .

Wanted signal mean power from companion device (dBm)	Unwanted signal frequency (MHz)	Unwanted CW signal power (dBm)
-30	2 395 or 2 488,5 (see note 1)	-35 (see note 2)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1.		
NOTE 2: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.		

LBT based Detect and Avoid- Frame Based Equipment

1) Before transmission, the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The equipment shall observe the operating channel for the duration of the CCA observation time which shall be not less than 18 µs. The channel shall be considered occupied if the energy level in the channel exceeds the threshold given in step 5 below. If the equipment finds the channel to be clear, it may transmit immediately.
2) If the equipment finds the channel occupied, it shall not transmit on this channel during the next Fixed

Frame Period.

The equipment is allowed to switch to a non-adaptive mode and to continue transmissions on this channel providing it complies with the requirements applicable to non-adaptive equipment. See clause 4.3.2.6.1. Alternatively, the equipment is also allowed to continue Short Control Signalling Transmissions on this channel providing it complies with the requirements given in clause 4.3.2.6.4.

3) The total time during which an equipment has transmissions on a given channel without re-evaluating the availability of that channel, is defined as the Channel Occupancy Time.
The Channel Occupancy Time shall be in the range 1 ms to 10 ms followed by an Idle Period of at least 5 % of the Channel Occupancy Time used in the equipment for the current Fixed Frame Period.

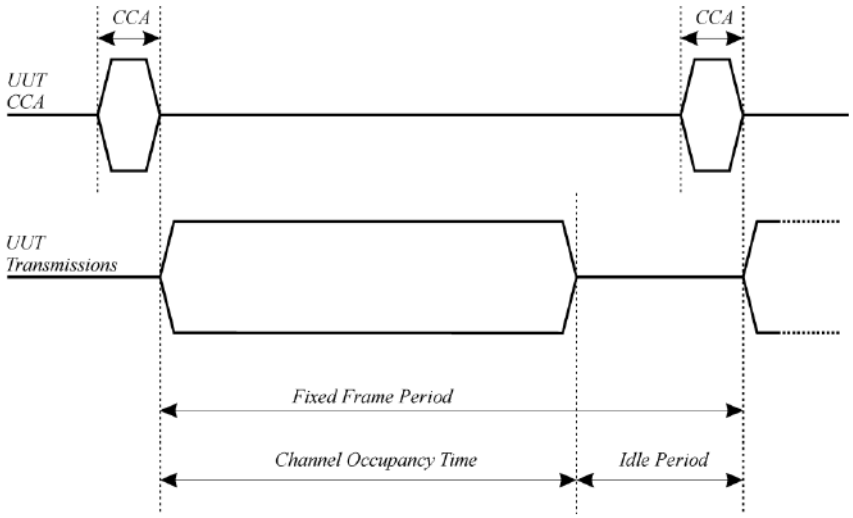
4) An equipment, upon correct reception of a packet which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames (e.g. ACK and Block ACK frames are allowed but data frames are not allowed). A consecutive sequence of such transmissions by the equipment without a new CCA shall not exceed the maximum Channel Occupancy Time.

5) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p. the CCA threshold level may be relaxed to:TL = -70 dBm/MHz + 10 × log10 (100 mW / Pout) (Pout in mWe.i.r.p.)

6) The equipment shall comply with the requirements defined in step 1 to step 4 in the present clause in the presence of an unwanted CW signal as defined in below table.

Wanted signal mean power from companion device	Unwanted signal frequency (MHz)	Unwanted signal power (dBm)
sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 3)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1. NOTE 2: A typical value which can be used in most cases is -50 dBm/MHz. NOTE 3: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.		

An example of the timing for Frame Based Equipment is provided in below figure .



LBT based Detect and Avoid-Load Based Equipment

1) Before a transmission or a burst of transmissions, the equipment shall perform a Clear Channel Assessment (CCA) check using energy detect. The equipment shall observe the operating channel for the duration of the CCA observation time which shall be not less than 18 μs. The channel shall be considered occupied if the energy level in the channel exceeds the threshold given in step 5 below. If the equipment finds the channel to be clear, it may transmit immediately.
2) If the equipment finds the channel occupied, it shall not transmit on this channel (see also the next paragraph). The equipment shall perform an Extended CCA check in which the channel is observed for a random duration in the range between 18 μs and at least 160 μs. If the extended CCA check has determined the channel to be no longer occupied, the equipment may resume transmissions on this channel. If the Extended CCA time has determined the channel still to be occupied, it shall perform new Extended CCA checks until the channel is no longer occupied.

   NOTE: The Idle Period in between transmissions is considered to be the CCA or the Extended CCA check as there are no transmissions during this period.

   The equipment is allowed to switch to a non-adaptive mode and to continue transmissions on this channel providing it complies with the requirements applicable to non-adaptive equipment. Alternatively, the equipment is also allowed to continue Short Control Signalling Transmissions on this channel providing it complies with the requirements given in clause 4.3.2.6.4.
3) The total time that an equipment makes use of a RF channel is defined as the Channel Occupancy Time. This Channel Occupancy Time shall be less than 13 ms, after which the device shall perform a new CCA as described in step 1 above.
4) The equipment, upon correct reception of a packet which was intended for this equipment can skip CCA and immediately (see also next paragraph) proceed with the transmission of management and control frames (e.g. ACK and Block ACK frames are allowed but data frames are not allowed). A

consecutive sequence of transmissions by the equipment without a new CCA shall not exceed the maximum channel occupancy time as defined in step 3 above.

For the purpose of multi-cast, the ACK transmissions (associated with the same data packet) of the individual devices are allowed to take place in a sequence.

5) The equipment, upon correct reception of a packet which was intended for this equipment can skip CCA andimmediately (see note 3) proceed with the transmission of management and control frames (e.g. ACK and BlockACK frames are allowed but data frames are not allowed). A consecutive sequence of transmissions by theequipment without a new CCA shall not exceed the maximum channel occupancy time as defined in step 3)above.

6) The energy detection threshold for the CCA shall be proportional to the transmit power of the transmitter: for a 20 dBm e.i.r.p. transmitter the CCA threshold level (TL) shall be equal to or less than -70 dBm/MHz at the input to the receiver assuming a 0 dBi (receive) antenna assembly. This threshold level (TL) may be corrected for the (receive) antenna assembly gain (G); however, beamforming gain (Y) shall not be taken into account. For power levels less than 20 dBm e.i.r.p., the CCA threshold level may be relaxed to:TL = -70 dBm/MHz + 10 × log10 (100 mW / Pout) (Pout in mWe.i.r.p.)

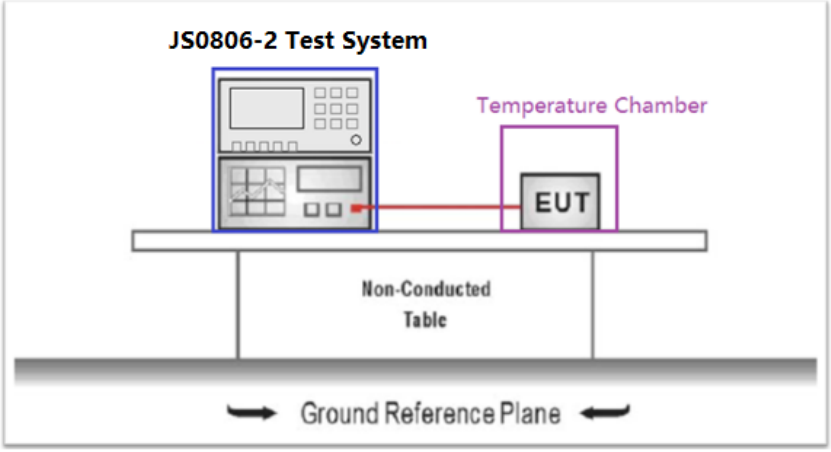
7) The equipment shall comply with the requirements defined in step 1 to step 4 of the present clause in the presence of an unwanted CW signal as defined in below table.

Wanted signal mean power from companion device	Unwanted signal frequency (MHz)	Unwanted signal power (dBm)
sufficient to maintain the link (see note 2)	2 395 or 2 488,5 (see note 1)	-35 (see note 3)
NOTE 1: The highest frequency shall be used for testing operating channels within the range 2 400 MHz to 2 442 MHz, while the lowest frequency shall be used for testing operating channels within the range 2 442 MHz to 2 483,5 MHz. See clause 5.4.6.1. NOTE 2: A typical value which can be used in most cases is -50 dBm/MHz. NOTE 3: The level specified is the level in front of the UUT antenna. In case of conducted measurements, this level has to be corrected by the actual antenna assembly gain.		

Short Control Signalling Transmissions

If implemented, Short Control Signalling Transmissions of adaptive equipment using wide band modulations other than FHSS shall have a maximum TxOn / (TxOn + TxOff) ratio of 10 % within any observation period of 50 ms.

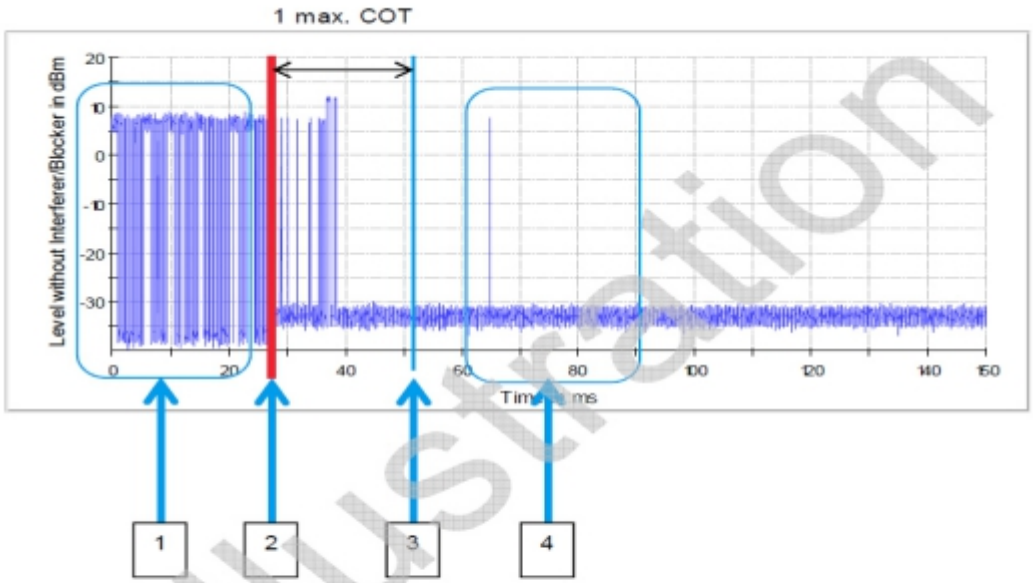
Test Configuration



Test Procedure

Please refer to ETSI EN 300 328 Sub-clause5.4.6.2.1 for the measurement method.

Adaptivity Test schematic graphic



1. Reference measurement (interferer off / Blocker off trace)
2. Interferer switched on (rise of the noise floor)
3. Arming of the video trigger one max. COT after interferer is switched on
4. Monitoring measurement triggered by the short signaling (interferer on / Blocker off traceor interferer on / Blocker on trace)

Test Results

Not applicable.

This requirement does not apply to adaptive equipment operating in a non-adaptive mode.

3.12. Receiver Blocking

Limits

ETSI EN 300 328 Sub-clause 4.3.2.11

Performance Criteria:The minimum performance criterion shall be a PER less than or equal to 10 %. The manufacturer may declare alternative performance criteria as long as that is appropriate for the intended use of the equipment

Receiver Category 1: Adaptive equipment with a maximum RF output power greater than 10 dBm e.i.r.p. shall be considered as receivercategory 1 equipment.

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 6 dB	2 380 2 503,5	-53	CW
P_{min} + 6 dB	2 300 2 330 2 360	-47	CW
P_{min} + 6 dB	2 523,5 2 553,5 2 583,5 2 613,5 2 643,5 2 673,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

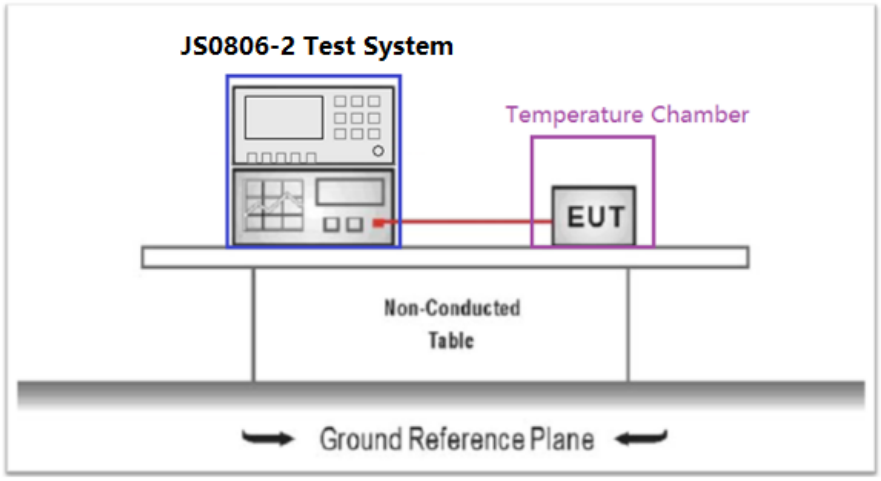
Receiver Category 2: Non-adaptive equipment with a Medium Utilization (MU) factor greater than 1 % and less than or equal to 10 % oradaptive equipment with a maximum RF output power of 10 dBm e.i.r.p. shall be considered as receiver category 2equipment.

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 6 dB	2 380 2 503,5	-57	CW
P_{min} + 6 dB	2 300 2 583,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

Receiver Category 3: Non-adaptive equipment with a maximum Medium Utilization (MU) factor of 1 % or adaptive equipment with amaximum RF output power of 0 dBm e.i.r.p. shall be considered as receiver category 3 equipment.

Wanted signal mean power from companion device (dBm)	Blocking signal frequency (MHz)	Blocking signal power (dBm) (see note 2)	Type of blocking signal
P_{min} + 12 dB	2 380 2 503,5	-57	CW
P_{min} + 12 dB	2 300 2 583,5	-47	CW
NOTE 1: P_{min} is the minimum level of the wanted signal (in dBm) required to meet the minimum performance criteria as defined in clause 4.3.2.11.3 in the absence of any blocking signal. NOTE 2: The levels specified are levels in front of the UUT antenna. In case of conducted measurements, the levels have to be corrected by the actual antenna assembly gain.			

Test Configuration



Test Procedure

Please refer to ETSI EN 300 328 Sub-clause 5.4.11.2.1 for the measurement method.

Test Results

Test channel	Pmin (dBm)	Wanted signal power (dBm)	Blocking signal frequency(MHz)	Blocking signal power(dBm)	Test PER(%)	Limit(%)	Result
LCH	-81.8	-75.8	2300	-47	2.0	<10	Pass
			2380	-57	2.1		
HCH	-80.7	-74.7	2503.5	-57	2.4	<10	Pass
			2583.5	-47	2.5		

Note:

1. The EUT is belong to category 2.
2. Wanted signal power (dBm) = Pmin + 6dBm.

4. PHOTOGRAPHS OF EUT CONSTRUCTIONAL

Reference to the test report No.: GTI20190656E

**********THE END**********